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SCIENCE

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CONTENTS

CONTEMPORARY DETERRENTS TO THE PROCESS OF CLINICAL MEDICINE[1]

INTRODUCTION.—It has been said that "Methods and view points rather than men determine periods in the history of medicine." Following an era dominated by the study of structural pathology and of those physical signs expressive of structural change, there occurred a rather abrupt transition to a period characterized by investigation of the *function* of the various organs of the body in health and disease. Within the past fifty years there has been an increasing utilization of the sciences of chemistry, physics, biology, and mathematics, employed by investigators in their endeavor to measure function in exact ways, to estimate the degree of functional impairment in an organ diseased, to establish diagnosis upon a functional basis, and to institute therapy along lines calculated to prevent *functional* deterioration. By some, the contemporary period is termed "the golden age in medicine." That period will have come more truly when there is a more appropriate correlation between functional impairment and structural change. Contemporary medicine has lost somewhat by its neglect of pathological anatomy.

This "functional" period in medicine has been marked by numerous well recognized trends. It has witnessed the development of an enormous number of laboratory tests and procedures. Many mechanical devices and instruments of precision have been introduced, designed to detect the slightest deviation from the so-called normal. The period has been associated with the sub-division of medicine into a great number of specialties, and a marked re-

[1] Presidential address read before the American Congress on Internal Medicine, at Rochester, Minnesota, April 7, 1922.

placement of the general practitioner by specialists. Changes have been so varied and rapid that medical education has been unable to keep pace with the growth of new theories, new methods, and new ideas of practice: with a result that the medical student of the day is subjected to a type of education which is, in the words of a well known college president, "about half a century behind other forms of higher instruction." Research and prematurely published articles are dominant features of the time. Progress during this era of "specialized functional-diagnosis" has unquestionably been great, yet humanity comes very far short of getting out of the medical profession the aid which it is capable of furnishing.

An analysis of these dominant factors in contemporary medicine reveals a timely and merited attempt to reduce medicine to the realms of a pure science, or, as one particular enthusiast states it, "Medicine should now be generally recognized as an independent science, dealing with the phenomena of disease." This statement may be accepted if by science is meant *knowledge* gained by systematic observation, experiment and reasoning. Reason, however, must always operate within experience, never beyond it. Science is experience becoming rational. Rationalized science becomes an art through the skillful application of knowledge to practice.

Clinical medicine will always remain an art expressing itself by the practical application of all scientific experience toward the cure, alleviation or prevention of disease; in this pursuit it does and must enlist in its service all of the sciences. "A good internist will be a better one if he is well trained in the so-called medical sciences, but the sum total of all the sciences does not make internal medicine, nor is a brilliant scientific education a prerequisite, for a useful clinical career." The sciences give the true clinician some of his most useful tools, but they do not constitute his art. Many of the factors to which may be ascribed the brilliance of contemporary medicine in a scientific sense are, in part, at least, responsible for some well recognized defects in the practice of clinical medicine that may actually hinder its progress. A brief consideration of some of them would, therefore, seem timely.

(A) The Menace of Excessive Laboratory Procedures

The elaboration and perfection of a large number of laboratory procedures has been a natural development in the evolution of contemporary medicine. To deny their usefulness would be absurd; to be forced to practice clinical medicine without laboratory facilities would be disastrous; to deny that important advances in clinical medicine have come from laboratory studies would be untrue. Every one admits that the patient dare not be studied at the bedside alone. It is certain that laboratories in the future will continue to play a dominant rôle in the advancement of medicine. It is equally true that medical investigation has gone more and more away from men engaged in clinical practice into the hands of laboratory workers, many of whom possess but a limited view of the problems which daily beset the practitioner. The enthusiasm for more accurate *diagnosis* characteristic of contemporary medicine, has, apparently, led many practitioners to believe that the laboratory simplifies everything; many actually seem to draw the inference from reading current laboratory advertisements, that clinical study can often be dispensed with in favor of containers for specimens, gratuitously supplied by commercialized laboratories. This excessive reliance upon laboratory tests has hindered the progress of clinical medicine in various ways as a result of:

(1) A tendency prematurely to accept and apply new laboratory tests of promise.

(2) The indiscriminate utilization of accepted laboratory procedures that are in reality of value only in a limited domain.

(3) An improper interpretation of tests of known value through ignorance of their clinical significance.

(4) An unwise reliance on positive laboratory findings to establish a diagnosis to the exclusion of other data, that may, perhaps, be much more important.

One witnesses examples of these and other errors almost daily. The total number of laboratory procedures or tests in themselves pathognomonically diagnostic is very small. There is practically none if diagnosis is understood to include, as it should, not only the cause of

the disease, but also its location, and the degrees of resultant structural functional impairment.

Confusion obviously exists, particularly among general practitioners, as to the correct use of many current laboratory procedures. This must in some way be overcome if the dangers arising from their improper utilization are to be eliminated, chief among which is an incorrect or incomplete diagnosis, and therefore inefficient service to the patient. Ways must be found to control or to limit the widespread application of tests that should be confined to well organized medical clinics, until the results there obtained have been subjected to long and critical analysis. The same is true of procedures requiring a degree of special technical ability not possessed by the average practitioner or technician employed by him. Witness merely as one example the widespread and misapplied study of basal metabolism, an instance of the mischief that inevitably follows the random use of mechanical methods. As Sir James Mackenzie has well put it, "While it may be claimed that we have one hundred new methods for investigating disease in the living, it must also be recognized that we have one hundred more ways for going astray. The benefit to the patient is often doubtful, and the employment of many contemporary laboratory methods in the contemporary manner is often harmful." The unintelligent use of laboratory tests is one etiological factor for the contemporary fibrosis and atrophy of the emotion of wonder and its associated instinct of curiosity: together "they arouse the impulse to approach and examine more closely the object or difficulty which excites them. Demand for the solution of a perplexity is the steadying and guiding factor in the entire process of reflection. Laboratory tests have certainly encouraged the development of a certain "naïveté of diagnosis" which seriously threatens the cultivation of a healthy curiosity.

(B) Specialism and Specialists

Contemporary specialism has been unavoidable. It has been pointed out that specialism is calculated to increase productivity, to facilitate the acquisition of accuracy, speed and skill, to provide a better distribution of tasks, to economize material equipment and mental energy, and to accelerate discovery and invention. Barker refers to a "virtuous circle," "for on the one hand specialism increases knowledge, and on the other the growth of knowledge and technique creates new specialties. Human wants grow as knowledge and skill increase, and ever new types of medical men must emerge to supply the services that will adequately satisfy these wants." Viewed from this rather broad philosophic standpoint, as well as from a purely practical one, it is probably true that the "abolition of specialism would compel a return to a darker age of medical practice."

But, whether specialism with its increasing sub-division can be applied to clinical medicine in the same way that it has been to commerce and industry is a very debatable question. Certain dangerous aspects of specialism are thought by many to be responsible for admitted deficiencies in the practice of medicine of to-day. These dangers doubtless represent not so much arguments against specialism as against its indiscriminate or unwise use. In specialism one easily recognizes the lure for those whose ambitions are more for material reward than for human uplift. To specialism may be attributed the existing inequality of the financial compensation of the specialist and of the general practitioner, and hence the economic situation that explains in part the present inadequate supply of physicians in rural communities. A contemporary anonymous writer sees the origin of specialism in surgery. The degree of specialism that has developed in this one *branch of medicine* alone has been as extraordinary as it has been absurd. It is cheerful, therefore, to read from no less a pen than that of William J. Mayo: "Surgery should be put back where it belongs—a means of mechanical therapy in conjunction with medicine which should not continue in competition with the internist, as it has in the past." Specialism has been responsible for the development of what might be termed class discrimination in the profession, by which the so-called general practitioner has seemed to lose caste. Applied to patients, it has also fostered a feeling of

class distinction, for many assume that the services of specialists are far beyond their means, when, as a matter of fact, such is not usually the case. The charge that the medical profession, as a whole, has rapidly become an organized financial institution is as untrue as it is unjust. Misapplied specialism is at least one explanation for the recourse of many misguided individuals to some one or other of the commercial cults, which prey like parasites upon their human victims. The greatest danger of all to clinical medicine lies in the fact that specialism carries with it the inherent danger of narrowness and monotony, potential foes of the faculty of concentration, the power of observation and decisive correlation. It tends fundamentally to destroy those intimate relations between physician and patient that constitute the very essence of the healing art. Osler, in 1919, wrote: "The extraordinary development of modern science may be her undoing. Specialism has fragmented the specialties themselves in a way that makes the outlook hazardous. The workers lose all sense of proportion in a maze of minutiæ." The profession and public, as a whole, appreciate the great services rendered by specialists. They are certainly indispensable. Specialism can probably not be checked, but unless its abuses are restrained a dark era in clinical medicine will have to be faced. Sanity and extremes never mix.

(C) Changes in Medical Practice

The development of "group clinics" is the most striking contemporary change in the practice of medicine and is a direct result of modern specialism. Group practice unquestionably has many definite advantages, but it is unquestionably destined to failure unless it consistently deals cooperatively and unselfishly with the general practitioner. All arguments that may be advanced in favor of group practice are outweighed if this fundamental consideration be neglected. This is but another way of saying that group medicine can justify its existence only in so far as its superior facilities for study and diagnosis can be directly transferred back to the patient through the medium of his family physician. The difficulties and dangers inherent in specialism become even more real in "diagnostic groups" unless there is the highest type of analysis and integration of the work done by the several specialists practicing together. Such analytical power is not possessed by many. It can be acquired only through long clinical experience, active clinical teaching and the opportunity to keep in touch with the advances in those specialties useful in clinical practice. It is rather hard to believe that men who possess these qualifications of the "diagnostic integrator" will serve the public and profession best by analyzing the reports of specialists. Granted that the work skillfully done is correctly analyzed and properly applied, failure none-the-less threatens "group medicine" if it be forgotten that impersonality in the practice of medicine inevitably foreshadows loss to the public.

(D) Changes in Medical Education

That there is something wrong with medical education almost every one will admit. Just where the defect lies, what the reasons are, and what constitutes the solution, remain somewhat obscure. Probably the most significant change in contemporary medicine from an educational standpoint has been the introduction of the so-called full-time system in the clinical departments. It is advocated by those who believe "that there exists, or can be created, such a thing as a science of medicine, which can best be fostered by giving it a place in which it can grow unhampered by the restrictions of practice." They claim that a close association between medical education and practice is by no means essential, and seem to resent the conception of clinical medicine as an application of the science to an art, or craft, or vocation. In these university medical schools with whole time clinical teaching, the number of students is to be limited and the selection of applicants would seem to favor most those of research tendencies and scientific trend. "The teachers should be carefully chosen young men who have shown ability not only to teach but also to aid in extending the boundaries of medical knowledge." The plan, as outlined by one author, whom I quote, "will not provide the student with the wide experience with disease in its various manifestations which would make him an able practitioner. Modern devel-

opments require for medical education a scientific basis with a final polish added by a preceptor system correctly applied."

There is such a thing as *impractical* idealism being carried too far. Every one admits the merits and advantages of full-time teachers, in medicine, as in any other science. Certainly no one could belittle the importance of research; only a traitor to the ideals of the medical profession would seek to hinder in any way the closest practical correlation between clinical teaching, research laboratories, and experimental studies. The whole basis for medical advance has been founded upon just this cooperation between the clinical practitioner, artisan if you will, and the research devotee, each serving and advancing the same science, but there never has been, and never can be, created a science of medicine apart from the practice of clinical medicine. If this be true, any educational movement designed to segregate one from the other will be disastrous to each. It is not implied that the advocates of full-time medicine actually have any such idea in mind, yet many believe their academic tendencies have made them lose sight of certain fundamental and practical issues. The so-called full-time movement probably is a step in the right direction. It is an experiment the results of which must be awaited with patience. If it is to be the best system applied to medical education, it is imperative that certain guiding principles be borne in mind as the scheme is worked out. To an active practitioner and teacher some of the most important points would seem to be these:

1. The fundamental *duty* and *moral* obligation of any medical school is to supply a needy public with an *adequate* number of alert, sane, and trustworthy practitioners as eager to prevent as to cure disease. This demands that they be well grounded in those essentials upon which the intelligent practice of medicine is based. To meet this need contemporary medicine must undertake a radical revision of both the pre-medical and the medical curriculum along lines that will better develop altruistic and humanitarian motives as the controllers of scientific ardor. The elective system should be encouraged in certain ways but discouraged in others; undergraduate specialism curtailed; and *research*, during student years, to the neglect of acceptable proficiency in the fundamental sciences and their practical application prohibited or at least critically limited. "Applying themselves early to research young men get into back waters far from the main stream. They quickly lose the sense of proportion, become hypercritical, and the smaller the field, the greater the tendency to megalocephaly" (Osler). It is believed that if medical schools would uniformly adopt such policies, the public would be the gainer, specialties would not lack for devotees, nor would scientific advancement be hindered. Wise education seeks to simplify and make clear—never to complicate and confuse.

2. The teachers employed in meeting this moral obligation must be qualified both to impart knowledge and to inspire enthusiasm. These requirements can not be met except by men who have demonstrated their ability to advance clinical medicine. Clinical teachers of this type can never be replaced, at least from the students' viewpoint, by younger men of great promise, but deficient in a most important attribute, namely, "responsible experience." It must be remembered that students are best stimulated by contact with clinicians of mature development and accredited success. Such men can neither be created merely by appointment nor developed by fiat. There is food for serious reflection as to the correctness of a contemporary system that fails to give to medical students the *best* teachers available.

3. A medical school does not completely fulfill its moral obligation to the community by the conferring of medical degrees. It is obligated to keep behind its graduates—and provide for them, as well as other practitioners, ready means for post-graduate instruction, for training in the various specialties, and for opportunities for higher research work. Facilities, money and teachers alone will not meet the demands. Of the greatest influence in a medical school is a harmonious whole, and enthusiastic cooperation of faculty, students, and alumni, in the performance of a common task, and a total abstinence from the slightest trace of intolerant cliquism. Regardless of the size or source of the budget, medical education is bound to fail in schools in which such an

atmosphere is not developed and maintained.

4. Finally, a medical school, both by precept and example, must seek to inoculate a sustaining philosophy in the souls of its graduates. The philosophy of medicine implies a cheerful acquiescence to the burdens of the day. It inspires the unfortunate and cheers the depressed. It teaches how to encourage the hopeless as well as to relieve the suffering. It provides courage and fortitude with which to meet sorrow and disappointment. Lived up to, it insures a geniality of soul and tolerance for the opinions of others. Dishonesty is its most hated foe. Such a philosophy is needed by every successful clinician: it is practical even though idealistic. It does not develop best in the materialistic atmosphere of a pure science not learned and pursued in love.

Conclusion.—Brief reference has been made to a few of the dangers inherent in some of the very factors that have made contemporary medicine so brilliant. To infer anything short of an attempt to be constructively critical is to misconstrue. It is hoped that every clinical practitioner and teacher will ponder deeply on these and kindred topics, for clinical medicine is destined to come into its own in the near future. This will be hastened if the entire profession takes a more active share in the direction of education and the enforcement of needed reforms.

Progress and optimism are the natural progeny of health; they wither in the face of disease. Preventive medicine, through domination of the forces of nature and their utilization in promoting the welfare of mankind, is the ultimate goal of medical science. Through science the facts are discovered, through clinical practitioners their application is effected. The prevention and cure of many diseases to which mankind is heir depends neither upon the acquisition of knowledge through scientific research alone, nor its proper application to patients in the limited domain of each practitioner. Medicine must have behind it the tremendous power of a concordant public opinion. To win this, scientists, teachers and practitioners must miss no opportunity to become active agents in the proper transmission of all useful knowledge to the public at large. In no other way can humanity be freed from the pernicious influence of quack remedies, cults of false pretenses, and a host of kindred delusions which drain the physical and financial and psychic resources of thousands every year. When fads and personal whims are kept constantly subservient to the weight of judiciously proved opinion, and if devotion to truth characterizes the daily life of student and physician—a grateful public will generously support all forms of needed medical investigation.

Sydney R. Miller

PHOTOPERIODISM, THE RESPONSE OF THE PLANT TO RELATIVE LENGTH OF DAY AND NIGHT[1]

In an article published in 1920[2] data were presented tending to show that the length of day may exercise a remarkable regulatory action in initiating or inhibiting sexual reproduction in plants. In a number of species studied it was found that ordinarily the plant can attain the flowering and fruiting stage only when the length of day falls within certain limits so that in such cases flowering and fruiting occur only at certain seasons of the year. In this respect some species and varieties respond to long days while others respond to short days. Moreover, some plants are much more sensitive to change in length of day than are others. Since the publication of this paper the investigations have been extended to cover various other features of plant activity as affected by the prevailing length of day, including increase in stature, aerial and subterranean branching, formation of tubers and bulbs, root-growth, leaf-fall, dormancy and rejuvenescence. In collaboration with C. W. Bacon of this office fairly extensive biochemical studies of the subject have been carried out to ascertain the nature of the internal chemical changes involved and their relationship to the observed responses

[1] The writers are indebted to Mr. O. F. Cook, of the Bureau of Plant Industry, for suggestion of the term *photoperiodism* to designate the phenomena in question.

[2] "Effect of the Relative Length of Day and Night and Other Factors of the Environment on Growth and Reproduction in Plants," in *Journal of Agricultural Research*, Vol. XVIII, No. 11, March 1, 1920, pp. 553-606.

of the plant. Inasmuch as publication of the details of these investigations has been considerably delayed it seems desirable at this time to briefly indicate the principal conclusions reached. The duration of the daily illumination period not only influences the quantity of photosynthetic material formed but also may determine the use which the plant can make of this material. In general, there is an optimal light period for maximum upward or apogeotropic elongation of the stem which for some species corresponds to the long summer days of higher latitudes, while for other species the intermediate length of day of spring and fall (or the equatorial day length) is optimal. Changes in the light period to sub-optimum conditions for stem-elongation, resulting from appropriate increase or decrease in length of day, as the case may be, may initiate a series of characteristic responses which are definitely associated with periodicity in plant behavior. Reference has already been made to flowering and fruiting. There seems to be an optimal light period for sexual reproduction which tends to direct the energies of the plant more or less quantitatively toward flowering and fruiting. Again, departure in day length from the optimal for increase in stature causes loss of dominance of the apical bud, thus promoting various types of branching. Leaf-fall and entrance upon the rest period, also, result from exposure to a certain length of day which is unfavorable for stem-growth. It has been found that there may be an intermediate length of day especially favorable to dormancy or death while under both longer and shorter days activity of the plant may continue. Further changes of the light period by a sufficient increment or decrement away from the optimal for increase in stature and beyond the optimal for sexual reproduction tend to induce intense tuberization, a feature marking the final stages in reduction of stem-elongation. Formation of bulbs is induced by excessively long days while formation of tubers commonly results from excessively short days. This deposition of carbohydrate in relatively condensed or dehydrated forms as a result of an unfavorable light period indicates marked loss of power to utilize the products of photosynthesis in elongating the stem or in developing flower and fruit, a condition well exemplified in the stemless or leaf-rosette form of foliage development. The opposite change toward the optimal day length for stem-elongation may rescue typical annual plants from impending death and effect more or less complete rejuvenescence. The evidence indicates that the degree of hydration of the living cell content is brought under delicate control by the ratio of the number of hours of sunlight to the number of hours of darkness in the 24-hour period. Well defined correlation has been established between the hydrogen-ion concentration of the cell sap and the observed responses of the plant to change in the length of the day. Thus, change from the purely vegetative to the flowering and fruiting stage may involve marked change in hydrogen-ion concentration in the apical bud and even a reversal of acidity relations between the apex and the base of the stem. Correlation also has been found between the content of "available" carbohydrate (the simpler sugars) and the responses of the plant to differences in length of day. Causal relationships, however, have not been definitely established. It seems probable that the annual cycle of length of day, affording as it does a consistently rhythmic feature of the external environment, is a dominant causal factor in phenomena of plant periodicity, subject, of course, to the modifying influences of temperature and other environmental factors.

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FISH PARASITISM IN ITS RELATION TO BIOLOGICAL PROBLEMS OF THE NORTHWEST[1]

IN this great Northwest of ours fish afford a natural resource of importance to the welfare of a good many citizens. Not only do the commercial interests utilize fish for market purposes, but the sportsmen derive infinite

[1] One of the papers in a *Symposium* on "Biology in Its Relation to the Development of the Northwest," presented at the meetings of the Western Society of Naturalists at Corvallis.

pleasure from angling them in every stream and lake which they can conveniently approach. And yet, it is no exaggeration to say that aside from some limited fish-hatching operations, we have done practically nothing to intelligently conserve these creatures for future generations.

Although there are a good many sides to the program of fish conservation, yet this evening I wish to bring to your attention only one phase of it, namely, fish-parasitism and point out some of the biological problems with which it is intimately linked up.

During the last few years I have been devoting a good deal of attention to fish-parasitism in the Northwest and can say that this is a field which has hardly been touched. There are great numbers of fish parasites in this region: *bacteria, protozoa, cestodes, trematodes* and *crustacea* which are infecting the fish and killing off great numbers of them. These afford many fields of investigation which are not only thoroughly scientific, but of great practical value. We need good taxonomic keys of these parasites, their life histories and their effects on the various hosts.

Furthermore, this knowledge should be supplemented by a careful study of the conditions within our lakes and streams which are conducive to fish-parasitism. At present we are working entirely in the dark, and as a result of it much of our good time, effort and money are wasted. I will cite but one instance along this line to make my point clear.

It is a common practice among our game commissioners to stock a body of water with fish and then to close it down for purposes of allowing the fish to multiply, with the view of obtaining a plentiful supply of spawn for hatching operations. My observations along this line have convinced me that this is an erroneous practice. In the first place, closing down a stream makes for a rapid multiplication of fish so that the available food supply soon becomes inadequate to maintain all of them. A fierce struggle for existence ensues in which many of the weaker, but nevertheless desirable fish are killed off. Even those that remain appear to be starved for lack of food. In the second place, the congested conditions within the stream make possible a rapid spread of any parasitic infection which happens to make its appearance among the fish. And lastly, when a stream is closed down for any length of time its shores afford an ideal, undisturbed habitat for many fish-destroying birds and other animals. These not only kill off large numbers of fish, but they may also be the means of disseminating various parasitic organisms among them.

It seems to me that before we can even talk of cure and prevention, we must know the parasitic organisms as well as the conditions which make parasitism possible. But, without these facts we are powerless to do any good. What is greatly needed in this Northwest section is a number of biological surveys for the purpose of studying and mapping out the various ecological factors of the regions in which fish or game are to be planted. We ought to know a good deal about such factors as available food supply, oxygen content, temperature variations, predatory and parasitic organisms, etc., of a place before any kinds of animals or plants are introduced into it. Knowing these conditions we can then intelligently fit each organism into that particular environment where it will thrive best. While the initial expense involved in the establishment of such surveys will be considerable, yet the benefits derived in the long run will more than repay us for our efforts.

NATHAN FASTEN
OREGON AGRICULTURAL COLLEGE

THE THIRD ASIATIC EXPEDITION OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE Third Asiatic Expedition of the American Museum of Natural History, in cooperation with the American Asiatic Society and *Asia* Magazine, will leave Kalgan on the nineteenth of April for the continuation of its work in Mongolia.

During the last six months field operations have been conducted in various parts of China which have been extraordinarily successful. All the members of the expedition's staff have now arrived in Peking and the final preparations

are being made for the coming summer's work.

The personnel consists of 25 men as follows:

Scientific Staff:

Roy Chapman Andrews, leader and zoologist.
Walter Granger, paleontologist.
Charles P. Berkey, geologist.
Frederick Morris, geologist and topographer.
J. B. Shackelford, cinematographer.
S. Bayard Colgate, motor transportation officer.
Persender, assistant transportation officer.
F. A. Larsen, field manager.

Native Personnel:

3 Chinese taxidermists.
3 Chinese cooks.
2 Chinese chauffeurs.
3 Mongol interpreters (Chinese-Mongol).
6 camel drivers.

AREA TO BE INVESTIGATED

Central and Western Mongolia from a line between Kalgan and Urga, west to the eastern extension of the Altai and Tian Shan Mountains and south to the frontier of Chinese Turkestan. This region, part of which lies between two old caravan trails, consists of the most arid section of the Gobi Desert, of rolling meadowlands and foothills at the bases of high mountains, some of which are covered with perpetual snow.

The Third Asiatic Expedition will carry on a reconnaissance of its zoology, geology, paleontology and geography. This survey will be preparatory to a more detailed study if the future of the region proves to be of sufficient scientific interest.

PLAN OF OPERATIONS

Due to the short summer advantage must be taken of the warm months when scientific studies can be carried on successfully. This is between April 15 and October 1. After these months snowstorms are of such frequent occurrence that effective work is difficult.

The expedition has purchased 75 camels which are already on their way to a point known as Turin, 175 miles south of Urga, transporting food, gasolene, motor equipment and scientific apparatus sufficient for six months. At Turin they will await the other members of the expedition.

On April 19 the remainder of the party will leave Kalgan in three Dodge motor cars and two Fulton one-ton motor trucks. They will begin scientific work immediately after leaving Kalgan and proceed slowly to Turin to connect with the caravan. From Turin the caravan will be sent westward towards a region known as Sain Noin Khan. The scientific staff will follow in the motor cars. After proceeding for perhaps a hundred miles a camp will be made and the smaller automobiles will be utilized by the scientific party to carry on their work. Horses and camels will be used to explore such regions as can not be reached by the cars. After working in a circle about the first camp the scientists will move a few hundred miles further and the same method repeated. The geologist, paleontologist and topographer will occupy one car, the zoologists a second and the photographer a third. Each party will be a complete mobile unit equipped with its own cook, driver and assistants and can remain away from the base camp as long as it is desirable.

By the use of motors for rapid transportation over the less interesting areas, it is believed that three seasons' work can be done in six months. The camel caravan will be sent ahead from place to place, thus acting as a movable base and as a reserve if the motor transportation does not prove as successful as is expected. The use of motor vehicles in this remote region is an experiment which should have considerable importance in demonstrating how accessible the country can be made in the future. The motors are equipped with all the latest devices and such a complete assortment of spare parts is being carried that it would be possible almost to construct a complete car if one was disabled. Mr. S. Bayard Colgate, who has charge of the motor transportation, is an expert in his line and has spent several weeks in the Fulton and Dodge factories familiarizing himself with every detail of the construction and repair of the cars.

Supplies of gasolene, oil, food and other essentials will be obtained every four or five days from the camel caravan which will be sent ahead from point to point as the field of operations is changed.

It is proposed to bring back a very complete record in motion pictures of the work of the

expedition, the life and customs of the people and the interesting features of the country. Mr. J. B. Shackelford, who is perhaps the foremost cinematographer of the United States, is equipped with three remarkable cameras which were invented by Mr. Carl Akeley of the American Museum of Natural History for natural history work. This camera can be leveled instantly without reference to the position of the tripod and with a turn of the wrist can be swung up and down, from side to side, or in any direction, thus obviating the clumsy panoramic device which is one of the most cumbersome features of the ordinary moving picture camera. A battery of lenses of all descriptions, including powerful telephoto lenses, will make possible the obtaining of animal photographs at long distances. Antelope, wild horses, wild asses and wild camels can be run down in the motor cars, and these exciting chases, which are a feature of hunting on the Mongolian plains, can be brought home in all their details. The expedition hopes to lasso many animals from the cars and send some of them alive to America. A complete record of the lives and customs of the Mongols, historically one of the most interesting peoples of the world, has never been attempted and this field has almost unlimited possibilities of the greatest scientific and popular interest.

Dr. Walter Granger, paleontologist of the expedition, ranks high in his profession throughout the world. Possibly no man is more familiar with the difficult technique of discovering and preparing fossils in the field than Dr. Granger. His many years of work in America on the evolution of the Eocene horse has brought to the American Museum of Natural History the finest collection of fossil horse material in the world. He also conducted extensive explorations in the Fayum Desert of Africa on the famous expedition under the direction of the distinguished president of the American Museum of Natural History, Professor Henry Fairfield Osborn. Dr. Granger has only recently returned from Eastern Szechuan, where he has been spending the winter investigating a fossil field not far from Wan hsien on the Yangtze River. This expedition has brought together an extremely interesting collection of fossils among which the primitive elephant *Stegedon* is particularly well represented.

Dr. Charles P. Berkey, who is professor of geology in Columbia University, has beeen connected with so many important operations in America, and is so well-known to the geologists of the world that special mention of his activities would be superfluous. Dr. Berkey, who has charge of all the geological work of the expedition will carry on a reconnaissance of structural geology and physiography of the areas to be visited in Mongolia and lay out general plans for further geological work. His attention will be particularly devoted to the Tertiary features of the region in relation to its bearing on the problem of the development of primitive man.

Professor Frederick Morris is a former colleague of Dr. Berkey in Columbia University and until the first of March was professor of geology in Pei Yang University at Tientsin. Professor Morris is an expert topographer and will have charge of the mapping and survey work of the expedition as well as assisting in geological investigations. Probably no man in America is better equipped for this work because of his exceptional ability in sketching and his familiarity with map-making and all phases of topographical study. A wireless equipment has been obtained and the American Legation wireless station will send over the correct time each evening at 7 o'clock, so that the exact geographical position of the party will be obtained.

Mr. F. A. Larsen, who will act as field manager in Mongolia, will bring to the expedition the benefit of his thorough knowledge of the country and its people and be of the greatest assistance in helping to adjust the various difficulties, such as will inevitably arise.

Roy Chapman Andrews, the leader and organizer of the expedition as well as directing the general operations, will conduct zoological investigations in mammals, birds, fishes and reptiles.

The purpose of the Third Asiatic Expedition is to carry on a coordinated investigation of various areas in Central Asia which have remained scientifically unexplored. It is the

consensus of scientific opinion that the Central Asian plateau, including Thibet, Chinese Turkestan and Mongolia, was not only the point of origin and distribution for many forms of animal life which exist to-day in America, Europe and many parts of the world, but was also the so-called "cradle of the human race." Although its important relation to human ancestry has long been recognized, no coordinated scientific investigation has ever been conducted on a large scale. Its zoology, paleontology, geology and botany bear the most intimate relations to the ancestry of man and it is with reference to this problem, which is of world-wide interest, that the expedition will conduct its work. It will furnish material for the Great Hall of Asiatic Life which is now being added to the buildings of the American Museum of Natural History in New York City. The expedition also proposes to present to the Chinese government a duplicate series of its collections which it is hoped will be used as the basis of a National Museum of Natural History in Peking.

The cordial support which all the officials of the Chinese government have accorded the expedition and the facilities which have been given to it for prosecuting its work, indicate what a keen appreciation of the value of scientific work there is in China.

The Chinese Geological Survey for a number of years has been carrying on geological and paleontological explorations in various parts of China and has already become an institution of recognized importance throughout the world because of the high standard of its work. The survey has cooperated in the most friendly and scientific spirit with the Third Asiatic Expedition and a plan of operations has been agreed upon which is proving of great mutual benefit.

The expedition expects to return from Mongolia about October 1, 1922. At that time Professor Henry Fairfield Osborn, president of the American Museum of Natural History, will arrive in Peking with his wife and daughter to inspect the results of the work and to plan for future investigations.

Professor Osborn is one of the greatest living authorities on the evolution of man. His visit to Peking can not but be an important event in the scientific life of China.

Mr. Clifford Pope, assistant in zoology, will not accompany the expedition to Mongolia but will continue his studies of the reptiles, fish and batrachians of China. He has already obtained more than 10,000 specimens and will visit all the provinces of China before his work is completed.

Mr. James Wong, interpreter, will make an expedition to Szechuan Province while the main party is in Mongolia. His work will be an examination and reconnaissance of the caves along the Yangtze River preparatory to paleontological studies for the winter of 1922-23.

Mr. Harry R. Caldwell, assistant in zoology, will continue his zoological survey of Fukien Province during the summer.

ROY CHAPMAN ANDREWS

PEKING, APRIL, 1922

SCIENTIFIC EVENTS

THE UNIVERSITY OF HALIFAX

DETAILS of the plan recently announced for amalgamating all institutions for higher education in the maritime provinces of Canada into a central university at Halifax, with the assistance of the Carnegie Foundation, have been made public. Alumni of the various colleges at present are considering the proposal. The plan proposes:

1. That there should be formed in Halifax an overhead university connected with all the colleges, but not particularly with any one, which should do the work of graduate and professional schools for the provinces; that is, the work now carried on by Dalhousie University in law, medicine, dentistry and pharmacy, and that carried on by the Nova Scotia Technical College in engineering, should be done by the university, together with the junior and senior years and the scientific portion of the freshman and sophomore years of each college.

2. That the various colleges situated outside of Halifax, namely, Acadia, Kings, Mount Allison, St. Francis Xavier and University of New Brunswick, should move to Halifax, erect buildings of their own, provide dormitory facilities, class rooms, dining rooms, chapel and other needed buildings for their own students, and in general conduct the work in English, French, German, Latin, Greek, mathematics and history for the first two years, caring for the housing and discipline of their students.

3. That all examinations should be conducted by the overhead university and all the degrees, with the exception of those in theology, be conferred by the university.

4. That financially the Carnegie Corporation would be willing to assist the colleges which would have to move, and perhaps also the overhead university, so that the general scheme might be well started, and then it was hoped the provincial governments would provide any money necessary for the overhead university; but all fees for classroom work should be handed over to the university, and that the colleges should only do such work as their endowments would permit.

ACTIVITIES OF THE ROCKEFELLER FOUNDATION

A REVIEW of the activities of the Rockefeller Foundation in 1921, written by its president, Dr. George E. Vincent, will be issued in a few days. The things done by the foundation directly and through its departmental agencies —the International Health Board, the China Medical Board, and the Division of Medical Education—are summarized as follows:

Continued a quarter-million annual appropriation to the School of Hygiene and Public Health of Johns Hopkins University;

Pledged two millions to Harvard for a school of health;

Contributed to public health training in Czechoslovakia, Brazil, and the United States;

Aided the Pasteur Institute of Paris to recruit and train personnel;

Promoted the cause of nurse training in America and Europe;

Underwrote an experimental pay clinic in the Cornell Medical School;

Formally opened a complete modern medical school and hospital in Peking;

Assisted twenty-five other medical centers in China;

Promised a million dollars for the medical school of Columbia University;

Contracted to appropriate three and one half millions for the rebuilding and reorganization of the medical school and hospital of the Free University of Brussels;

Made surveys of medical schools in Japan, China, the Philippines, Indo-China, Straits Settlements, Siam, India, Syria, and Turkey;

Supplied American and British medical journals to 112 medical libraries on the continent;

Supplemented the laboratory equipment and supplies of five medical schools in Central Europe;

Defrayed the expenses of commissions from Great Britain, Belgium, Serbia, and Brazil;

Provided 157 fellowships in hygiene, medicine, physics, and chemistry, to representatives of eighteen countries;

Continued a campaign against yellow fever in Mexico, Central and South America;

Prosecuted demonstrations in the control of malaria in ten states;

Cooperated in hookworm work in nineteen governmental areas;

Participated in rural health demonstrations in seventy-seven American counties and in Brazil;

Neared the goal of transferring to French agencies an anti-tuberculosis organization in France;

Provided experts in medical education and public health for counsel and surveys in many parts of the world, and rendered sundry minor services to governments and voluntary societies.

THE ANNUAL MEETING OF THE AMERICAN CERAMIC SOCIETY

THE American Ceramic Society held its twenty-fourth annual convention at the Hotel Statler, St. Louis, Mo., February 27 to March 3. One and a half days were devoted to general sessions, one and a half days to divisional meetings, and two days to plant visits.

An organization of 1,575 members, it has seven industrial divisions, all of them strong and independent of one another, but united in one body, the American Ceramic Society.

On the program for the general sessions, there were nineteen papers and seven films. The Art Division had seventeen papers besides demonstrations. The Enamels Division had seventeen papers, four colloquiums, and one extensive report of their research committee. The Glass Division had fourteen papers, six colloquiums and two reports of their research committee. The Heavy Clay Products Division had eight papers and four colloquiums. The Refractories Division had twenty-five papers and twelve topics for discussion. The Terra Cotta Division had fifteen papers. The White Wares Division had sixteen papers and three colloquiums.

The society is governed by a board of trustees consisting of the president, vice-president, secretary, treasurer, and five trustees. The

president-elect is Frank H. Riddle, of Detroit, Mich.

Mr. Riddle finished his course at the Ohio State University in 1904 and since that time has had broad experience in the manufacture of art pottery, terra cotta and heavy clay products. He is at the present time consulting engineer and chief chemist of the Champion Porcelain Company and the Jeffery-DeWitt Insulator Company. For two years prior to the war, as well as during the war, he was a member of the technical staff of the Bureau of Standards. It was he, more than any one else, who developed the spark plug used in the aeroplane during the war. The spark plugs made prior to that time would not stand the high tension and were a source of disastrous breakdown. Mr. A. V. Bleininger, then director of the Ceramics Division of the Bureau of Standards, assigned Mr. Riddle to this problem and with him made investigations of the composition and methods of manufacture that resulted in the spark plug of exceedingly low coefficient of expansion and of very high dielectric strength. Mr. Riddle has been associated with the society for several years and has been a member of the board of trustees for two years. The society has enjoyed a very large growth in membership under his direction as chairman of the membership committee.

The other members of the board of trustees for the coming year are:

E. W. Tillotson, Mellon Institute, Pittsburgh, Pa., *vice-president.*

R. K. Hursh, University of Illinois, Urbana, Ill., *Treasurer.*

R. C. Purdy, Columbus, Ohio, *General Secretary.*

R. H. Minton, General Ceramics Co., Metuchen, N. J., *Trustee.*

F. K. Pence, Knowles, Taylor & Knowles, East Liverpool, O., *Trustee.*

R. M. Howe, Mellon Institute, Pittsburgh, Pa., *Trustee.*

B. E. Salisbury, Onondaga Pottery Company, Syracuse, N. Y., *Trustee.*

THE ILLINOIS STATE ACADEMY OF SCIENCE

ONE of the most successful meetings ever held by the Academy of Science was the fifteenth annual meeting at Rockford on April 27, 28 and 29. A strong representation of members attended, and the Illinois Branch of the Mathematical Association of America held its annual meeting in conjunction with the academy for the first time. Fifty-seven new members were elected to the academy; the treasurer's report showed a good balance on hand; members took part in presenting strong papers at the general and section meetings; and thus the academy affairs were shown to be in good condition.

Committees on membership, on ecological survey, on high school science and clubs and on publications gave interesting and encouraging reports.

The following resolution was adopted, and copies have been sent to all Illinois senators and representatives in Congress:

RESOLVED: (*a*) That the Illinois State Academy of Science records its earnest hope that in the tariff legislation now under consideration by the Congress of the United States, provision may be made for duty-free importation of scientific apparatus for the use of educational institutions,—a privilege that has contributed in no small degree to the wonderful progress made in science and its applications in the educational institutions of this country during the past few decades.

(*b*) That this resolution be spread on the minutes of the meeting and that certified copies of it be sent to the Senate and House committees by which the new tariff bill is being shaped up, and to each member now representing Illinois in the Senate and House of Representatives.

Another resolution was adopted urging the academy members to cooperate with other scientific organizations whose purpose it is to promote the use of the metric system of weights and measures, so that the public in general may become familiar with the advantages of this system, and so that proper legislation may be enacted. A committee on metric system was appointed to act on the above resolution.

The academy members were guests of the Rockford University Club at dinner April 27, and the Rockford Chamber of Commerce acted as hosts on one of the field trips April 29 down the beautiful Rock River Valley. A second field trip, taking two days, was conducted by H. S. Pepoon to Apple River Canyon. These geological and biological trips were much enjoyed.

The following officers were elected for 1922-1923:

President: W. S. Bayley, University of Illinois.
Vice-president: W. G. Waterman, Northwestern University.
Secretary: C. Frank Phipps, State Teachers College, DeKalb.
Treasurer: W. F. Schulz, University of Illinois.
Librarian: A. R. Crook, State Museum, Springfield.

C. Frank Phipps,
Secretary

THE THIRD INTERNATIONAL CONGRESS OF THE HISTORY OF MEDICINE

The International Society of the History of Medicine was founded in Paris on October 8, 1921. It has for its object the study of the history of medicine in all its branches and the coordination of research work in these subjects. A permanent committee has been established in Paris consisting of delegates appointed by sections of the society in various countries.

The society meets in congress every three years, and it has been decided to hold the next meeting in London from July 17 to 22, 1922. Meetings will be held at the Royal Society of Medicine, the Royal College of Physicians, the Royal College of Surgeons, the Wellcome Historical Medical Museum and elsewhere. There will be special exhibitions of objects connected with the history of medicine, surgery and the allied sciences. The loan of any objects of special interest from members will be greatly appreciated by the executive committee.

Communications are invited from members on subjects connected with the history of medicine in all its branches. The following subjects have been suggested for communication and discussion, but are by no means intended to exclude papers on any subject of general interest in connection with the history of medicine:

1. The principal seats of epidemic and endemic diseases in the Occident and Orient in the Middle Ages, including plague, gangrenous ergotism, leprosy and malaria.
2. The history of anatomy.
3. The revival of medical knowledge during the sixteenth century.

Communications should be addressed to: The General Secretary, Dr. J. D. Rolleston, 21, Alexandra Mansions, King's Road, London, S. W. 3.

The other officers are: President of honor, Sir Norman Moore, Bart., M.D.; vice-presidents of honor, Sir D'Arcy Power, K.B.E., F.R.C.S., Professor Ménétrier, Professor Jeanselme, Dr. Tricot-Royer; president of congress, Charles Singer, M.D.; treasurer, W. G. Spencer, O.B.E., M.S.

SCIENTIFIC NOTES AND NEWS

The Croonian lecture was delivered before the Royal Society on June 1, by Dr. T. H. Morgan, professor of experimental zoology in Columbia University. His subject was "The mechanism of heredity."

Dr. Ross G. Harrison, of Yale University, has been elected an honorary member of the Royal Academy of Medicine of Turin.

Dr. William Bateson, F.R.S., director of the John Innes Horticultural Institution at Merton, Surrey, has been elected a trustee of the British Museum, to fill the vacancy caused by the death of Lord Harcourt.

At the quarterly meeting of the Royal College of Physicians at Edinburgh it was resolved to offer its honorary fellowship to Professor Albert Calmette, of the Pasteur Institute, Paris, on account of his distinguished services to medical science.

The University of St. Andrews will confer the degree of LL.D. on July 7 on Sir P. R. Scott Lang, emeritus professor of mathematics in the university; on Dr. G. R. Marshall, professor of materia medica, University of Aberdeen; and on Sir Harold J. Stiles, regius professor of clinical surgery, University of Edinburgh.

John K. Haywood, chairman of the Insecticide and Fungicide Board of the U. S. Bureau of Chemistry, recently completed a quarter of a century of service at the bureau, and was the recipient of a gold watch from his present and former colleagues.

T. M. Bains, assistant professor of metallurgy at the Missouri School of Mines and Metallurgy at Rolla, Mo., has accepted the position of geologist with the Moctezuma Copper Company, Pilares de Macodari, Sonora, Mexico.

DR. EDWIN C. ERNST, St. Louis, was elected president of the American Roentgen Ray Society, central section, at the meeting held recently in Chicago.

G. R. MANSFIELD has been placed in charge of the section of the U. S. Geological Survey devoted to non-metalliferous deposits.

LEON F. CURTISS, instructor in the department of physics in Cornell University, has received an appointment from the National Research Council as national research fellow in physics. He expects to pursue special investigations at the Cavendish Laboratory, Cambridge.

THE Franklin Institute has awarded to Professor Eugene C. Bingham, of Lafayette College, its certificate of merit for his improved variable pressure viscometer.

THE Committee on Scientific Research of the American Medical Association has awarded to Dr. F. W. Mulsow, a grant of $225 for work on a selective medium for gonococcus.

THE new buildings of the Astrophysical Observatory at Potsdam are to be controlled for the next ten years by a committee consisting of the director of the observatory, Professor Einstein, Dr. Freundlich, Professor Bosch, and Dr. R. Schneider.

A TESTIMONIAL fund is being raised for Mr. E. Grey, field superintendent of the Rothamsted Experiment Station, who has completed fifty years' work at the station.

THE retirement of Professor Ambronn, of the Observatory at Göttingen, has been announced. Dr. Meyermann, formerly director of the Observatory of Tsingtau, and subsequently a prisoner of war in the hands of the Japanese, has been appointed to succeed him.

PROFESSOR P. P. VON WEIMARN has been appointed research associate of the Imperial Research Institute of Osaka, Japan, charged with the creation of a laboratory for research in colloids.

MEMBERS of the American Chemical Society resident in Morgantown, West Virginia, met at the university on May 12 to elect permanent officers for the North Western Virginia Section of the society, the charter, for which section was just recently granted. The following officers were elected: *President,* Dr. F. E. Clarke; *secretary-treasurer,* Dr. E. P. Deatrick; *vice-president,* Professor W. W. Hodge; *counselor,* Dr. H. G. Knight. The section consists of thirty-four members.

ON May 9, ex-Provost Edgar F. Smith, of the University of Pennsylvania, closed a series of public lectures given at Connecticut College by professors from Harvard, Yale, Columbia, the University of Minnesota, and the University of Chicago. Dr. Smith's subject was "Chemistry and civilization."

DR. JOHN A. DETLEFSEN, of the University of Illinois, delivered Sigma Xi lectures at Purdue University on April 21 and at Northwestern University on May 19, on the subject of "Recent experiments and observations bearing on the inheritance of acquired bodily modifications."

DR. RICHARD C. TOLMAN, director of the Fixed Nitrogen Research Laboratory, Washington, delivered a lecture on the "Quantum Theory," May 16, before the Scientific Society at Swarthmore College.

H. C. PARMELEE, editor of *Chemical and Metallurgical Engineering,* addressed on May 10 the Chemical Society of the Massachusetts Institute of Technology on "The chemist in public life."

AT a joint meeting of the Washington Academy of Sciences with the local section of the American Institute of Electrical Engineers, on May 18, Dr. A. Van Dyck, of the General Electric Company, delivered an address on "The vacuum tube in present day radio."

THE Miami Aquarium and Biological Laboratory, Miami Beach, Florida, on the grounds, building and equipment of which nearly $400,000 has been expended from private sources, has had a successful winter season of collecting and classifying, adding many new specimens to the exhibit in its fifty tanks. After careful deliberation the officers of the Miami Aquarium Association decided to close the station for the summer, in order that necessary changes in tank arrangement and water

supply might be made and at the same time to save the heavy overhead operating expenses at a period of the year when daily attendance of visitors is very small. The station will open again next December. Seventy thousand persons visited the Aquarium during the recent winter and spring months—January to April, 1922. If the investigators specializing in ichthyology decide to take advantage of the unusual opportunity offered by the Biological Laboratory, it will hereafter be kept in operation continuously throughout the year; otherwise, the very heavy overhead expense makes its twelve-month-a-year availability prohibitive, and, as the station is supported by private contribution, its laboratory will not be kept open throughout the year unless a number of investigators decide to apply for tables.

THE laying of the cornerstone of the building to be erected in Panama by the Gorgas Memorial has been postponed until February 7, 1923. It was intended to lay the stone during the visit to the isthmus of Dr. Richard Strong, of the School of Tropical Medicine of Harvard University and member of the governing board of the Gorgas Memorial, but on the suggestion of Admiral Braisted and others the ceremony was deferred until next year, on the occasion of a visit of a group from the American College of Surgeons. This group from the College of Surgeons, numbering several hundred, are planning a trip through South America to hold clinics in the principal cities. It is expected that they will hold a clinic in Panama. In any event the party will cross the Isthmus. That time is to be taken for the laying of the cornerstone of the Gorgas Memorial Building to be erected here. The building in Panama for the Gorgas Memorial is to be devoted to research in tropical medicine and sanitation, and will house laboratories as well as executive and record offices, etc. It will be built on the seafront, close by the new Santo Tomas Hospital, overlooking the Pacific. Its cost is estimated at about $500,000.

THE Association to Aid Scientific Research by Women reports that at the recent annual meeting thirteen theses were submitted in competition for the Ellen Richards Research Prize of $1,000. Of these essays six were from Great Britain, five from the United States, one from Australia and one from a Russian woman doing research work in New York. Since its establishment the prize has been awarded five times, three times to American competitors and twice to English competitors. While the prize for 1922 was not awarded, as in the opinion of the judges none of the essays were of the same grade as those to which the prize has been awarded previously, the judges gave such high credit to one of the papers submitted that the association voted honorable mention with a grant of $1,000 to the author. This is the first time the grant has been made, and it carries with it the stipulation that "the grant shall be made only on the basis of submitted work and shall be used for the immediate continuation or completion of a definite piece of research." To these conditions the writer of the paper entitled "An investigation of the critical electron energies associated with the excitation of the spectra of helium and their significance in relation to certain modern views of the stationary states of the helium atom" has agreed and therefore the grant has been awarded to Miss Ann Catherine Davies, Royal Holloway College, Englefield Green, Surrey, England. Miss Davies holds the B.Sc. degree from the University of London, 1915, and the M.Sc. degree from the same university, 1917.

WE learn from the *British Medical Journal* that the officers of the Section of Anesthetics at the forthcoming annual meeting of the British Medical Association in Glasgow have arranged the following program: (1) A discussion on the broncho-pulmonary complications following operation under anesthesia; (2) a paper and demonstration by Dr. A. L. Flemming on effects produced by exposing tissues to various concentrations of anesthetic vapor; (3) demonstration of anesthetic apparatus. The officers of the Section of Microbiology (including Bacteriology) have arranged the following provisional program: (1) "The bacteriophage," by Dr. F. D'Herelle (Pasteur Institute, Paris) and Dr. F. W. Twort; (2) "The bacteriology of influenza," by Dr. Mervyn H. Gordon; (3) "Some similarities and dissimilarities in the microbiology of plant and animal diseases," by Professor V. H. Blackman; (4) "Mutation of species," by Dr. W. B. Brierley. Demonstrations will be arranged by Sir Wil-

liam Leishman, Professor Graham Kerr, and others. The officers of the Section of Anatomy have chosen the following preliminary list of subjects for discussion: (1) "The relation of the urethra to the vagina," by Professor J. C. Brash (Birmingham); (2) "The naked-eye anatomy of the bone marrow, with age changes," by Mr. Piney (Birmingham); (3) "The teaching of anatomy by radiology in the anatomy department," by Dr. J. M. Woodburn Morison (Manchester); (4) "The problem of the structure of the vertebrate head," by Dr. W. B. Primrose (Glasgow); (5) A discussion on the administration of the Anatomy Act will be opened by Dr. Alexander Macphail. Dr. Adam Patrick (16, Buckingham Terrace, Glasgow, W.), one of the honorary secretaries of the Section of Medicine, writes to say that he or his co-secretaries will be glad to hear of any members who might wish to submit short papers in the section, in addition to having the names of any who desire to take part in discussions. The meetings of the sections will be held on Wednesday, Thursday and Friday, July 26, 27 and 28.

UNIVERSITY AND EDUCATIONAL NOTES

IT is announced that the contest of the will of Amos F. Eno will be settled out of court by the payment of about four million dollars to Columbia University. The 1915 will, which has been twice broken by juries but both times upheld by courts on appeal, gave the residuary estate to Columbia University. The will made bequests of $250,000 each to the Metropolitan Museum of Art, the American Museum of Natural History, the New York Association for Improving the Condition of the Poor, and the New York University. Had the will been broken finally, these institutions would have received nothing. Whether they receive the full $250,000 each under the settlement, or what proportion of the total they receive, is not disclosed. The Society of Mechanics and Tradesmen received $1,800,000 under the 1915 will, and had that will been broken would have received $2,000,000 under an earlier will. This institution could not therefore be called upon to sacrifice anything in order to satisfy the heirs, and will receive the full $1,800,000.

DR. SYDNEY WALKER, JR. has provided $200 per annum for a scholarship for the furtherance of research in physiology at the University of Chicago in memory of his son.

DR. HERBERT W. MUMFORD, who has been away for a year on leave of absence from the University of Illinois as director of live stock marketing for the Illinois Agricultural Association, has been appointed dean of the College of Agriculture as successor of Dr. Eugene Davenport, who retires after twenty-seven years service at the end of the present year.

DR. WALTER R. MILES, research psychologist at the nutrition laboratory of the Carnegie Institution of Washington, Boston, has been appointed professor of experimental psychology at Stanford University, to fill the vacancy created by the retirement of Professor Frank Angell at the close of the present academic year. Dr. Angell has been professor of psychology at Stanford almost from the time of the opening of the university, having joined the faculty in 1892.

DR. HARRY D. KITSON, professor of psychology at Indiana University, will lecture at the summer session of New York University School of Commerce and Finance, giving courses on employment psychology and the psychology of advertising and selling.

DISCUSSION AND CORRESPONDENCE

THE WRITING OF POPULAR SCIENCE

TO THE EDITOR OF SCIENCE: I have read with much interest Dr. Slosson's letter[1] referring to my recent remarks[2] regarding the writing of popular science. I fear that Dr. Slosson has missed the main object of those remarks. They were not primarily intended to discourage the presentation of "mere information," though they did aim to discourage the practice of calling such matter "science," and of describing it as "scientific," but they were especially intended to point out the need of driving home to the layman the fact that science does not consist in the accumulation and cataloguing of such information, but in the establishing of relations between observed facts.

[1] SCIENCE, 55: 480, 1922.

[2] SCIENCE, 55: 374, 1922.

The layman has for so long been fed, under the guise of science, upon mere information that has, so far as he can see, no significant use or relation to anything with which he or his neighbors are in any way concerned, that he has acquired a false idea of what science really is. He is prone to regard scientists as visionary, unpractical freaks who spend their time in hunting up queer facts and in dreaming fantastic dreams, as harmless imbeciles who putter around at things that are of no interest to any one else, who from a depraved taste talk a jargon that others can not understand, and who once in a while by pure chance stumble upon something that some more sensible individual is able to put to some real use. This false conception should be rectified. In my opinion this can not be done by the simple process of offering the layman a larger or a more varied diet of mere information, even though this diet is guaranteed to conform to all the pure food laws. It must be done by driving home the fact that the prime object of science is the establishing of relations between facts, the facts themselves being merely incidental to that, and in many cases of no other interest whatever; and by showing him that the facts that are presented for his consideration have significant relations to those he already knows and of which he appreciates the importance.

I realize that the preparation of articles suited to these purposes is difficult, and I sympathize with Dr. Slosson in the difficulty he is experiencing in getting them; but the presence of difficulties should not deter us from facing the issue squarely and trying to meet it. Articles setting forth relations between facts can not be reeled off by the yard, their preparation is slow and laborious; also it is a work purely of love, other recompense than the joy of the work being insignificant. Consequently, such articles can be expected only from those scientists whose daily work of getting a living is such that they have considerable leisure. Does this not in part explain why Dr. Slosson finds more writers of good popular science in England than in this country?

Be this as it may, I am convinced that the layman's keen interest in science will awake when, and only when, he has been brought to recognize that science is concerned primarily in the establishing of relations, and that thereby he will be enabled to forecast and to control future events with ever greater and greater certainty.

N. Ernest Dorsey
404 Maryland Building,
Washington, D. C.

To the Editor of Science: Certain scientific men are attacking us editors of daily and Sunday newspapers and charging us with fabrication and exaggeration in our presentation of scientific matter for popular reading. As the editor of the Sunday magazine section of a metropolitan newspaper which has for many years been doing its best to keep the general public informed of the latest developments in science, permit me to present the other side of the case.

In my earnest efforts to publish the truth, the whole truth and nothing but the truth about such matters, I have over and over again asked men who are eminent in their specialties to write articles for me. But, with a few rare exceptions, the articles they have furnished me have been failures, because written in a style that, however appropriate for a purely scientific magazine, was utterly unsuitable for the average reader, because filled with technicalities which only the highly educated could be expected to understand. The fault I have to find with our American men of science when writing of their specialties is that they fail to present their ideas in the simple language and with the clarity of expression which are so necessary if one is going to awaken the interest of the "man in the street." In this respect, they are far behind their British, French and Italian fellows.

So far as the New York Sunday *World Magazine,* over which I have authority, is concerned, it has been our persistent policy for the last ten years to print nothing except that for which we have the very best authority obtainable. We devote two pages every Sunday to scientific matter; the greater part of which is quoted literally from the scientific and medical magazines. Besides this, when any highly im-

portant scientific discovery is made, we devote a special article to it, generally in the form of an interview with either the discoverer himself or the greatest available authority on the subject, and all such interviews are revised by the man interviewed and not printed until he has given them his O. K. In other cases, the facts are taken from a book or article written by the discoverer and are presented as his say-so and not as ours.

Quite recently we have received from some of the most eminent scientists in the world letters heartily congratulating us on the way in which we have presented articles that had specially interested them. I recall one from the late Professor Baskerville, another from Professor Milllikan, and the most recent of all are from Dr. L. O. Howard of the U. S. Bureau of Agriculture and Professor E. L. Bouvier of Paris on a page review of the latter's book on the "Psychic Life of Insects," translated by the former, both of whom are enthusiastic in their congratulations.

I venture to ask if you can find fault with Mr. Arthur Benington's article "The Chemists' Battle with Death" on page 2 of our magazine section of Sunday, April 9? Is there anything in that which is lax, inaccurate or "falsified"? Is this a "hoax"? If so, the hoax is not ours, but that of the leading chemists of the United States. I might ask the same question about dozens of articles we have published within the last few years.

That there are newspapers which publish fake science, I know as well as you, and that there are scientists who lend their names to such fakes—at a price—you ought to know as well as I. But, in condemning the few fakers, it is unfair and unjust to condemn also those which are honestly striving to interest and inform the general public on scientific affairs.

I sympathize with Mr. Slosson in his difficulty of finding men with the ability to write on scientific matters for the general reader. I have had the same difficulty, but I flatter myself that I have a few men on the staff of the Sunday *World* whose knowledge of science may not be that of specialists, but is, what is far more valuable, broad, thorough and comprehensive, and to this knowledge they unite an ability to convey to the man in the street a good idea of even the most abstruse subjects—witness, for example, our exposition of the Einstein theory, which was the best really popular article on the subject that it has been my good fortune to read. My long experience proves to me that the worst writers on scientific subjects are scientific men, for the reason that they do not know how to make their writings interesting and it is manifestly futile to publish uninteresting articles, for no one will read them.

J. O'H. COSGRAVE,
Sunday Editor
THE WORLD,
NEW YORK CITY

THE UNIVERSITY OF GRAZ

TO THE EDITOR OF SCIENCE: A letter was received by me some time ago, the English translation of which runs as follows:

University of Graz, Austria.
Institute for Plant Physiology.

Graz, January 22-22.

Dear Colleague:

Due to the collapse of our exchange, the condition of science in this country is getting worse every day. This fact brings back to me the promise you gave me last fall, at the laboratory of Dr. Went (Utrecht, Holland). You promised me to send, after your return to the United States, the *Botanical Abstracts*, possibly also reprints of anatomical and physiological work.

I am forced to bring this conversation to your remembrance because I am unable to see any other way to obtain American literature. The value of the Austrian crown is so deeply depressed that the rate of exchange, even with Germany, is 60-70 crowns pro mark. To buy foreign literature is of course out of the question. The University of Vienna enjoys the support of many financially influential persons. Our small university in Graz, however, lacks any such support. It is even difficult to produce enough energy required for scientific endeavor.

My short stay with Dr. Went has shown to me clearly the hopeless position of our Austrian institutes.

Nothing will describe the situation better than the following statement: my (recently increased) annual income is about twelve thousand crowns (about $1.40). I hope you will not feel offended when, under such circumstances, I bring back to

your remembrance the help you promised me last year. Sincerely yours,

(Signed) K. Linsbauer.

L. B. Becking

Department of Botany,
Stanford University, California

REQUEST FOR PAPERS ON GEOLOGIC DIFFUSION

I have received from Professor Raphael Ed. Liesegang, of the Institut für physikalische Grundlagen der Medizin, Schloss Str. 21, Frankfurt am Main, who is well known for his studies of diffusion and of the phenomena generally referred to as "Liesegang rings," a letter in which he requests that geologists who may publish, or who have recently published, papers dealing with the relation of ore deposition to colloid chemistry or diffusion will forward to him copies of their works. He explains that he desires these for abstracting for the "Kolloid Zeitschrift" and for use in the preparation of new editions of his books on *Geologic Diffusion* and on *Agates*. Hitherto he has obtained such papers by personal letters to their authors, but the present postage rate from Germany is so high as to make a continuance of this practice a heavy burden on his resources.

Geo. Otis Smith,
Director
United States Geological Survey

ATMOSPHERIC POLLUTION

Readers of Science have been in touch with the work of the Committee for the Investigation of Atmospheric Pollution. In the issue for April 22, 1921, a review of the Sixth Report is given, and in the issue for November 28, 1919, a summary of the Fourth Report.

The Seventh Report has now appeared[1] giving results of measurements of the deposits from 31 stations. During the year, automatic apparatus for measuring suspended impurity was set up at six stations.

The tables are similar to those in previous reports, and cover:

1. Monthly deposit for two selected stations, representative of high and low deposits such as central Birmingham and Rothamsted.

2. Total solids deposited monthly at all stations.

3. Mean monthly deposits at all stations for the summer half years, *i. e.*, April to September, 1919 and 1920.

4. Mean monthly deposits at all stations for the winter half years, *i. e.*, October to March, 1919-1920 and 1920-1921.

5 and 6. Classification of the stations according to amounts of various elements of pollution.

7 to 10. Totals of stations as classified for each element of pollution.

There is also a discussion of the type of deposit gage. The metallic gage, even when varnished, gave traces of metallic salts; and the glass gage proved too fragile; and finally enameled stoneware was adopted. One set of gages has been provided with Nipher shields to improve the catch; and it would seem as if the amount so caught now agreed closely with the catch of the rain gage, which was not the case previously.

A twin atmospheric pollution gage has been devised and put in operation at Rochdale by Dr. Ashworth and an attempt made to measure the quantity of impurities brought into the town and the amount carried out.

The west wind brought 14.8 tons per square kilometer; and 11.84 tons were carried out by the east wind. The data covered a period of five months. The amount brought in by the west wind, however, is not sufficient to account for Rochdale's high atmospheric pollution.

From the records of the instruments at the Meteorological Office it would appear that in London domestic fires are responsible for nearly two thirds of the total smoke.

The relation between health and impurity is discussed by Dr. J. S. Owens.

Curves were prepared in which the daily deaths of London were plotted with the data for maximum suspended impurity in the air. Temperatures were also considered.

There is a tendency for the death rate to reach a maximum when the impurity is highest or rather a little later.

On the whole there is no obvious relationship between the quantity of impurity and the number of deaths in London.

Dr. Owens also contributes an article on "London Fog in November," describing measurements made of the black particles. These

[1] M. O. 249. Meteorological Office, Air Ministry, London, 1922. Price 2s.

varied from .00013 mm to .00026 mm in diameter. The thickness of the water film was probably .0014 mm. He compares these with the diameters of fog particles measured by Barus in his experiments on atmospheric nucleation. He also treats of the sources of solid particles in London fogs. These come quickly, the air being relatively clean at 6 a.m.; and heavily laden with smoke fog by 9 a.m. When the air in London is fairly clear in winter, the amount of suspended matter is approximately 1 milligram per cubic meter; during a dense fog it rises to 5 mgs/m³. A rough estimate of the weight of the impurity in a fog for an area of 310 square kilometers (120 square miles) and a height of 122 meters gives 193 tons. According to Dr. Owens the amount of smoke produced between 6 a.m. and 10 a.m. from domestic fires and factories is sufficient to account for this load of suspended matter over London on a foggy day at 10 a.m.

Dr. Owens touches on the amount of dust in expired air. It has been assumed by medical men that the air passage through nose and throat practically trapped all the solid impurities. He doubts this and some experiments which he made seem to prove that in ordinary breathing the expired air contained about 70 per cent. of the suspended impurity which entered during inspiration. It seems certain that suspended matter is not entirely removed by action of the respiratory passages. In fact, only about 30 per cent. is removed.

Quite a good deal of space is given to a discussion of the relation of visibility to suspended impurity. The discussion is technical and no definite conclusions are reached.

Research work on measurements of acidity in the suspended matter of air is in progress.

ALEXANDER MCADIE

SPECIAL ARTICLES

STUDIES OF THE POLLEN TUBES AND ABORTIVE OVULES OF THE GLOBE MUTANT OF DATURA

THE Globe mutant, like the twelve or more other ($2n+1$) mutants already described (1 and 3), owes its mutant character to the presence of a single extra chromosome, the somatic number being 25 instead of 24. One of us (2) has shown by means of breeding tests that the inheritance of Globes is almost exclusively through the ovules, by which it is transmitted to only one quarter of the offspring whether the parent Globe is selfed or is pollinated by a normal diploid. Pollen from a Globe when applied to stigmas of a normal parent transmits the Globe complex to considerably less than 3 per cent. of the offspring.

Our colleague, Mr. Belling, finds that half of the pollen grains of Globe plants receive the extra chromosome. The fact that some of the ovules transmit the character, while some give rise to normal plants, indicates that a similar segregation takes place in the formation of the ovules. While the back-cross of Globes x normal pollen does not produce more than about one quarter Globes in the offspring, there are more than enough small aborted ovules in the seed pod to account for the missing Globes necessary to satisfy the expected 1:1 ratio of Globes to normals. We may safely infer, therefore, that half of the mature megaspores within the ovules receive the extra chromosome.

If there were no losses through bad pollen or abortion of ovules, the expected result of selfing ($2n+1$) Globes would be 25 per cent. normal diploid plants with the formula $2n$, 50 per cent. ($2n+1$) Globes, and 25 per cent. ($2n+2$) Globes with two extra chromosomes in the Globe set. Instead, we get mostly normals, with only about 25 per cent ($2n+1$) Globes and but rarely a ($2n+2$) Globe.

The problem here is to find if possible exactly where the losses are incurred, whether in pollen grains which fail to germinate, in pollen tubes which fail to grow fast enough to reach the ovary, or which fail to fertilize the ovules, or entirely in zygotes which are lost in the aborted ovules.

Aborted ovules were counted in seed pods that were nearly ripe. These can be seen with a hand lens or binocular dissecting microscope on the enlarged fleshy portion of the placentæ among the seeds.

Two classes of aborted ovules were recognized, the tiny apparently unenlarged ovules and those that were distinctly enlarged. The

enlarged ovules were doubtless fertilized while the tiny ovules which were probably but not certainly fertilized were counted as fertilized when they were located among the enlarged ovules and seeds.

Counts of the aborted ovules in well filled seed capsules resulting from abundant hand pollinations were as follows:

A. Normal x Normal, 6-9 per cent. (exact average for 5 capsules was 7.6).

B. Normal x Globe, 10-15 per cent. (exact average for 5 capsules was 12.8).

C. Globe x Normal, 22-34 per cent. (exact average for 5 capsules was 29.5).

D. Globe x Globe, 35-50 per cent. (exact average for 4 capsules was 39.4).

Since the Globe character is transmitted through the pollen parent in less than 3 per cent of the seeds, the discrepancy in the number of abortive ovules between A and B as well as between C and D suggests that 4-10 per cent. of the $(n+1)$ pollen tubes enter the ovary. More extensive studies will be needed to justify this tentative conclusion but the data at hand seems to indicate this and that there is a much greater mortality of Globe zygotes than of normals in embryonic development.

The style of Datura, as in many angiosperms, contains a central core of conducting tissue which is soft and fibrous, made up of narrow linear shaped cells, extending lengthwise of the style and terminating in the stigma where these cells become papillate. The pollen tubes, aided by a process of digestion grow down to the ovary through this tissue.

For a study of the pollen tubes, receptive stigmas were pollinated with a single layer of pollen in order to insure opportunity for uniform germination. This was done by applying the pollen in moderate quantities and blowing off the excess which was not immediately held by the stigmatic fluid. The styles were removed after a given period of time, scalded in hot but not boiling water (about two minutes) their cortex slit lengthwise by passing them through a groove in which the sharp corner of a fragment of a razor blade protruded slightly. This treatment facilitated the removal of the cortical tissue by dissection, leaving only the central strand of conducting tissue with which the stigma is continuous at the end. These central cores were stained in magenta (acid red), washed a little in water and mounted whole on a slide using concentrated lactic acid as a mounting medium and clearing agent. Balsam mounts were not found satisfactory but these lactic acid preparations have kept for more than six months.

Pressure applied to the cover glass will spread this tissue out in a thin layer, and the pollen tubes may be seen even under low power (better after 12-24 hours) as dark red streaks imbedded among the elongated pink-stained cells of the conducting tissue. Germinated pollen grains are transparent and may be recognized only by their empty shells (the exine walls) while the ungerminated pollen grains will stain a deep red. This method makes possible reliable counts of the number of ungerminated pollen grains and the num-

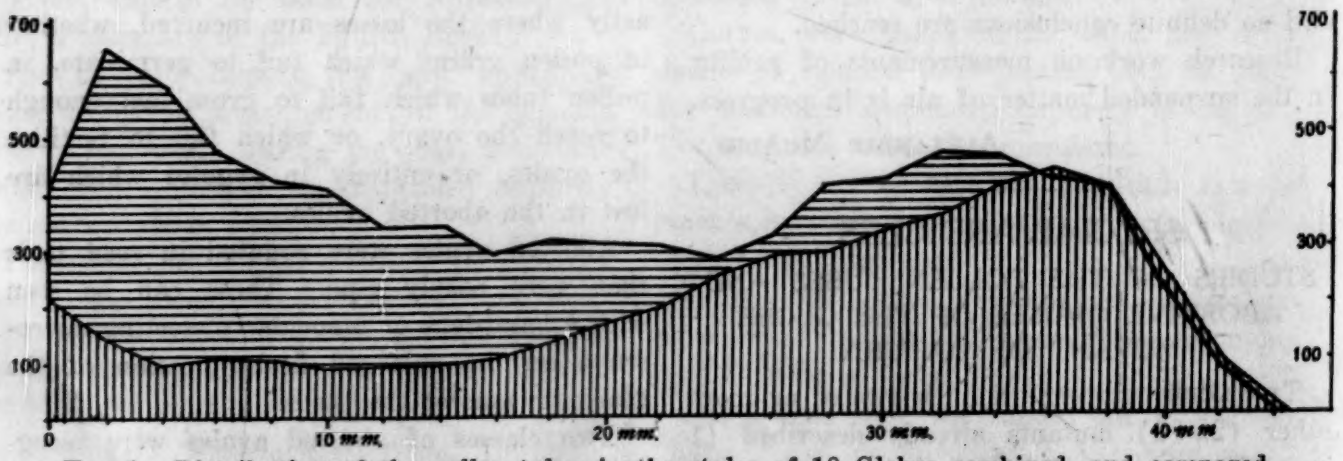

Fig. 1. Distribution of the pollen tubes in the styles of 18 Globes combined, and compared with 11 normals. Stigma is at left and the pollen tubes were growing to the right. Values plotted at O distance represent the ungerminated pollen grains.

ber of pollen tubes in various portions of the style at any given time after pollination.

Though a lateral displacement of the pollen tubes results from the flattening of these strands of conducting tissue, every pollen tube is practically in place with reference to its distance from the stigma or ovary. By means of a microscope equipped with a mechanical stage it was found possible to count their number and measure their distance from the end of the stigma, down as far as they had penetrated, from which their curves of distribution could be plotted and studied.

In the adjoining diagram the pollen tube distribution curves were made by superposing the pollen tube counts of a dozen or more styles whose foremost pollen tubes had penetrated to about 42 mm. The counts were made for 2mm. intervals and this represents their distribution about fourteen hours after pollination under fairly uniform temperature conditions—approximately 20°C. The bimodal curve is for Globes selfed and represents a total of 8,365 pollen grains applied to 18 stigmas under similar conditions, while the curve of distribution for selfed normal plants is shown superposed on this and represents 4,691 pollen grains applied to 11 different stigmas. In the normals the germination was 95.6 per cent. while the Globe pollen selfed gave a germination of 94.9 per cent. The curves are much more jagged when the pollen tube populations from individual styles are plotted but those from Globes are quite as characteristically bi-modal.

The explanation offered is that though the Globe pollen selfed germinates about as well as the normal pollen selfed, there are slower growing pollen tubes among the rapidly growing ones and soon this population of gametophytes becomes resolved into two groups which grow at slightly different rates. This bi-modal character increases with time, and the slowest pollen tubes may fail to fertilize because they fail to enter the ovary before abscission of the style, or they may fail only because the ovules were already fertilized by the more rapid pollen tubes. Since the Globe character is only slightly transmitted through the pollen, we infer that the pollen tubes with $(n+1)$ chromosomes are the slow ones, while the tubes with n chromosomes are those in the lead.

While this study is very largely still in its preliminary stages, it seems to show that we have in Datura a selection between gametophytes, one of the special forms of Developmental Selection described by one of us (4), thus proving that this form of selection is subject to experimental study. The result of our preliminary study also shows that the Globe, as well as the other $(2n+1)$ mutants of Datura, illustrates a condition in which the mutations tend to disappear because they are not favored by the processes of Developmental Selection.

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JOHN T. BUCHHOLZ,
ALBERT F. BLAKESLEE
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THE MATHEMATICAL ASSOCIATION OF AMERICA

The sixth annual meeting of the Mathematical Association of America was held at the University of Toronto on Thursday and Friday, December 29 and 30, 1921. One hundred and ten were in attendance at the sessions of the association, 88 of these being members of the association. The following papers were read at the meeting aside from the papers by Professors Carmichael, Curtiss and Slaught on the program of the joint sessions with the American Mathematical Society, and Section A of the American Association:

Outlines of Certain Fields of Research:

(*a*) "Foundations of geometry," by Professor Oswald Veblen, Princeton University.

(*b*) "Calculus of variations," by Professor G. A. Bliss, University of Chicago.

(It is frequently urged that college and university teachers should be engaged in some form of productive work, but many college instructors do not know promising lines of investigation and do not know how and where to find the literature which will inform them what has already been done in various lines. A suggestion has been made that the Association can do a valuable service if on its programs and through the *American Mathematical Monthly* university teachers map out for college teachers possible lines of research growing readily out of college courses. These papers afford a beginning of such suggestions.)

"Courses in mechanics for students majoring in mathematics," by Professor E. V. Huntington, Harvard University.

"Topology of three-dimensional manifolds in three dimensions," by Professor Norman Miller, Queen's University.

"Functionality in mathematical instruction in schools and colleges," by Professor E. R. Hedrick, University of Missouri.

"An example in the inversion of upper limits and bounds," by Professor Samuel Beatty, University of Toronto.

"New mathematical periodicals," by Professor G. A. Miller, University of Illinois.

"Proof of the fundamental theorem regarding the length of a curve," Professor J. L. Synge, University of Toronto, by invitation.

At the business meeting the following officers for 1922 were elected:

President: R. C. Archibald, Brown University.

Vice-presidents: R. D. Carmichael, University of Illinois, and B. F. Finkel, Drury College.

Trustees: L. P. Eisenhart, Princeton University; E. V. Huntington, Harvard University; D. N. Lehmer, University of California; G. A. Miller, University of Illinois; E. J. Wilczynski, University of Chicago.

The trustees elected to membership 58 individual members and 4 institutional members.

The financial report indicated an estimated surplus of $240 on the year's business.

The full proceedings of the meeting were published in the *Monthly* for March, 1922.

W. D. CAIRNS,
Secretary-Treasurer

THE AMERICAN MATHEMATICAL SOCIETY

THE twenty-eighth annual meeting of the society and the forty-eighth regular meeting of the Chicago section were held at the University of Toronto on Wednesday and Thursday, December 28-29, in affiliation with the meetings of the American Association for the Advancement of Science. The regular sessions of the society were held on Wednesday, President Bliss occupying the chair, relieved by Professors P. F. Smith and C. N. Haskins. On Thursday morning there was held a joint session with Sections B and C of the American Association and the American Physical Society, and on Thursday afternoon a joint session with Section A and the Mathematical Association of America. The attendance included 84 members. At the meeting of the council on Wednesday, 61 persons were elected to membership in the society.

At the annual election the following officers and other members of the Council were chosen: *Vice-presidents,* R. D. Carmichael and D. E. Smith; *secretary,* R. G. D. Richardson; *treasurer,* W. B. Fite; *librarian,* R. C. Archibald; *committee of publication,* E. R. Hedrick, W. A. Hurwitz, J. W. Young; *members of the Council,* to serve until December, 1924, J. W. Alexander, Henry Blumberg, L. L. Dines, F. R. Sharpe.

The total membership of the society is now 1,005, including 85 life members. The total attendance of members at all meetings, including sectional meetings, during the past year was 420; the number of papers read was 175. At the annual election 169 votes were cast. The treasurer's report shows a balance of $10,604.22, including the life membership fund of $7,528.87. Sales of the society's publications during the year amounted to $3,222.16. The library now contains 6,014 volumes, excluding 500 unbound dissertations.

The program of the joint session of Thursday morning was as follows:

I. Atomic nuclei and extra-nuclear electronic configuration, by Professor J. C. McLennan, retiring vice-president of Section B.

II. Symposium on quantum theory: for Section C, Dr. R. C. Tolman; for the American Mathematical Society, Professor H. B. Phillips; for

the American Physical Society, Dr. Saul Dushman.

The joint session on Thursday afternoon has already been reported under Section A.

The following papers were read at the regular sessions of the society:

Differential geometry of an m-dimensional manifold in a euclidean space of n dimensions: C. E. Wilder.

Differential geometry of an m-dimensional manifold in a euclidean space of n dimensions. Second paper: C. E. Wilder.

A modification of Peano's postulates for positive integers: M. H. Ingraham.

Riemann geometry and its generalizations: L. P. Eisenhart and Oswald Veblen.

The problem of apportionment. The method of the weighted geometric mean: R. W. Burgess.

Necessary and sufficient conditions in the problem of apportionment: E. V. Huntington.

Commutativity of contact transformations of mechanics: S. D. Zeldin.

Substitutions which are commutative with every substitution of an intransitive group: G. A. Miller.

Seeming contradictions in the theory of groups: G. A. Miller.

Convergence-factors in Cesàro-summable series: W. A. Hurwitz.

Note on the determination of the rectilinear secular trend of an ordered series of statistical relatives: W. L. Crum.

Provisions for depreciation based directly upon appraisal: C. H. Forsyth.

Plane algebraic curves invariant under a given quadratic Cremona transformation: Arnold Emch.

Canonical systems and the general problem of dynamics: Joseph Lipka.

Euler squares: H. F. MacNeish.

The expression of general forms as determinants whose elements are forms. Preliminary report: H. S. Everett.

The arithmetic mean of the least and greatest of n measurements: E. L. Dodd.

Convex distribution of the zeros of Sturm-Liouville functions: Einar Hille.

On Kellogg's diophantine problem: D. R. Curtiss.

The isodyadic quintic equation: J. S. C. Glashan.

On the isodyadic septimic equation: J. S. C. Glashan.

Criteria for relative root distributions: C. F. Gummer.

The algebraic theory of algebraic functions: Samuel Beatty.

An algebraic proof of the existence of the branches of an algebraic function: I. R. Pounder.

On the determinant of an hermitian matrix of quaternionic elements: E. H. Moore.

Some properties of the surfaces which represent the real and imaginary components of a function of a complex variable: E. J. Wilczynski.

Note on differential invariants: O. E. Glenn.

Hesse's associated points and the Weddle surface: Louise D. Cummings.

Some of the principles of the operation with series applied to a partial fraction problem: I. J. Schwatt.

Expansion of powers of infinite series: I. J. Schwatt.

A symbolic theory of formal modular invariants: Olive C. Hazlett.

The equivalence of expansions in orthogonal functions: Norbert Wiener and J. L. Walsh.

The next meeting of the society was held in New York City on February 25, this being the only meeting held in New York during the spring.

R. G. D. RICHARDSON,
Secretary

THE two hundred and twenty-second regular meeting of the American Mathematical Society, being the seventeenth regular Western meeting, and the forty-ninth regular meeting of the Chicago Section, was held at the University of Chicago on Friday and Saturday, April 14 and 15, 1922, in honor of the twenty-fifth anniversary of the Chicago Section. The attendance at these meetings was approximately one hundred and fifty, and included one hundred and four members of the society.

At the meeting of the council, ten persons were elected to membership in the society. Professor A. B. Coble was reelected a member of the editorial committee of the *Transactions* for a term of three years, beginning October 1, 1922.

The council accepted for the society the trust of the Eliakim Hastings Moore Fund, tendered through Professor Arnold Dresden, chairman of the committee that had collected the fund; this fund is to be used for the publication of mathematical books and memoirs, and the award of prizes. In this connection a pleasant feature was the presentation at the dinner on Friday evening of a testimonial to Professor Moore from his former students and

fellow-members of the Chicago Section. A more detailed account of this testimonial and of the establishment and purposes of this fund has appeared in SCIENCE.

The session on Friday afternoon was devoted to a symposium lecture by Professor A. B. Coble, on "Cremona transformations and applications to algebra, geometry and modular functions," followed by questions and discussion. The following papers were read at the other sessions of the society, those of Professors Dresden, Shaw and E. H. Moore being by request:

Abstract definitions of the symmetric and alternating groups and certain other permutation groups: R. D. CARMICHAEL.

On the zeros of successive polars of a binary form: D. R. CURTISS.

Relations between kindred P and Q functions: D. R. CURTISS.

On the equivalence of the Cesàro and Hölder means for multiple limits: C. N. MOORE.

On convergence factors in triple series and the triple Fourier series: BESS M. EVERSULL.

Independent sets of coaxial minors of determinants: E. B. STOUFFER.

On the minimizing of a class of definite integrals: P. R. RIDER.

On the approximate representation of periodic functions of two variables: ELIZABETH CARLSON.

Substitution groups whose cycles of the same order contain a given number of letters: G. A. MILLER.

Conformal transformations of linear homogeneous difference equations and their invariants: S. D. ZELDIN.

A new form of integral expansion: NORBERT WIENER.

Note on certain semi-invariants of n-lines: LENNIE P. COPELAND.

Residues of figurate numbers: O. E. GLENN.

Inter-variate correlation and the successive measures of dispersion in an ordered statistical series: W. L. CRUM.

Inter-variate partial regression equations in an ordered statistical series: W. L. CRUM.

Concerning relatively uniform convergence: R. L. MOORE.

On the cut-points of continuous curves and of other connected point sets in space of two dimensions: R. L. MOORE.

A solution of a spinning oblate spheroid two-body problem: F. E. CARR.

The elliptic modular functions associated with the elliptic norm curve E^7: ROSCOE WOODS.

Die Zerlegung von Primzahlen in algebraischen Zahlkörpern: ANDREAS SPEISER.

A boundary value problem in the calculus of variations: G. A. BLISS.

Certain generalizations of osculatory interpolation: J. F. REILLY.

A survey of the scientific work of the Chicago Section, 1899-1922: ARNOLD DRESDEN.

On functional transformations: J. B. SHAW.

On the determinant of a hermitian matrix of quaternionic elements. Definition and elementary properties with applications: E. H. MOORE.

Trigonometric expansion of aperiodic functions: T. C. FRY.

Mathematical paradoxes involved in the new Bucyrus gasoline shovel: R. S. HOAR.

On permutable quadratic forms in infinitely many variables: E. W. CHITTENDEN.

A fundamental system of invariants of a modular group of transformations: J. S. TURNER.

Note on a generalization of the strophoid: F. H. HODGE.

Ruled surfaces of Green-reciprocal correspondences: E. P. LANE.

The Laplace-Poisson mixed equation: K. P. WILLIAMS.

A criterion from integral equations relating to the existence of solutions for the one-dimensional boundary value problem: H. T. DAVIS.

A general criterion relating to the existence of solutions for the one-dimensional boundary value problem: H. T. DAVIS.

A continuous curve in the rôle of a space: R. L. WILDER.

Continuous transformations in analysis situs: N. J. LENNES.

On the foundation of the theory of sets: N. J. LENNES.

An error in the theory of differential equations by Lie's method: L. E. DICKSON.

Present status of the history of the theory of numbers: L. E. DICKSON.

The determination of a seasonal variation: W. L. HART.

Concerning compact Kürschák fields: V. D. GOKHALE.

A second mechanism for illustrating lines of force: W. H. ROEVER.

R. G. D. RICHARDSON,
Secretary